The Fabrication of the First French Spoke Prototype

J. Lesrel, CNRS, IPN Orsay

The fabrication of the first β=0.35 spoke-type cavity was recently achieved, leading us to proceed with its industrial fabrication by the French company CERCA at Romans. This talk describes the fabrication process of this cavity prototype.

Within the framework of the collaboration between FRAMATOME-ANP and the CNRS, IPN and CERCA have started a tight collaboration to build our first spoke cavity. This French company, ISO 9000 certified, is well-known for its ability in fabricating cavities.
The prototype was delivered middle July. For the fabrication we used 3 mm thick Niobium sheets (RRR>250) coming from Tokyo Denkai Co, Ltd.

All the cylinders (i.e. the beam and coupler tubes, the spoke bar and the body) are fabricated by roll-welding. Each weld is made with an electron beam welding machine under high vacuum (<10-5 mbar).

The flanges are carved directly into Niobium rod (this allows us to anneal the cavity without caring for diffusion problems into the furnace). Then, they are welded to the beam tubes.
The walls are made by spinning and the iris hole is done by extrusion. The stiffeners are welded on the beam tubes (8 grooves are made on the tubes to set precisely the supports). Then, the stiffeners-beam tubes set is welded on the wall. At last, the stiffeners are welded by spot on the re-entrant part of the wall.
The spoke bar is realised by squeezing the central part using a forging press.
After doing the beam hole, a rim-like tube is welded on the center.
Finally, these pieces are welded on the cavity body.
Before each welding, pieces are cleaned (BCP, rinsing and drying under ultra-pure nitrogen). Dimensional controls are performed on each stage of the fabrication process to control a possible buckling due to the welding. This first prototype will allow us to validate the design (with respect to electromagnetic and mechanical properties) but also the fabrication process.